

PIERCE NUT INSTALLATION APPARATUS

FIELD OF THE INVENTION

5 **[00001]** This invention relates a pierce nut installation apparatus which more accurately locates a pierce nut in a panel and prevents cocking of the pierce nut in the plunger passage.

BACKGROUND OF THE INVENTION

10 **[00002]** Pierce nuts were invented and commercially developed by the predecessor in interest of the assignee of this application primarily for mass production applications for the automotive and appliance industries. As will be understood by those skilled in this art, a pierce nut includes a projecting pilot portion which punches an opening in a panel and the pierce nut is then installed in the pierced
15 opening by a die member or die button. In a typical application, one die member or die platen, typically the upper die member, includes a pierce nut installation apparatus or head having a reciprocating plunger and the opposed die member includes a die button opposite the plunger of the installation head. A pierce nut is installed in a panel supported on the die button which each stroke of the die press. There are
20 various types of pierce nuts available from the assignee of this application generally including a central projecting pilot portion which pierces or punches an opening in the panel, a bore through the pilot portion which is generally threaded, flange portions on at least opposed sides of the pilot portion and panel receiving grooves located either in the pilot portion or the end face of the flange portion. Pierce nuts may be formed in a
25 rolling process or by cold heading.

[00003] A conventional pierce nut installation apparatus or installation head includes a pierce nut feed passage receiving pierce nuts for installation by the

installation apparatus, a plunger passage communicating with the feed passage receiving pierce nuts from the plunger passage and a plunger reciprocating through the plunger passage generally having a planar end face which engages a pierce nut received in the plunger passage and drives the pierce nut through the plunger passage
5 against a metal panel located opposite the plunger passage on a die button as described above.

[00004] There are two problems associated with the installation of pierce nuts utilizing a conventional pierce nut installation apparatus which is addressed by the pierce nut installation apparatus of this invention. One problem is
10 accurately locating a pierce nut in a panel. As will be understood by those skilled in this art, several pierce nuts may be simultaneously installed in a panel with each stroke of the die press and a second element may be attached to the panel with bolts or the like utilizing more than one pierce nut, requiring very accurate placement of the pierce nuts in the panel. At present, the datums for alignment are measured between
15 the circumference of the thread cylinders of the pierce nuts, requiring several datums for each pierce nut installation. It would be desirable, however, to measure the datums between the axes of the bores of the pierce nuts, significantly reducing the datums, but no method or apparatus has yet been developed which permits measurement of the datums between the axes of the pierce nut bores. As mass
20 production methods become more sophisticated, this has become a more serious problem.

[00005] Another problem associated with pierce nut installation apparatus is cocking of the pierce nut in the plunger passage. This problem may be reduced by the use of fingers which receive the pierce nuts and travel with the pierce
25 nuts to the panel during installation of the pierce nuts by the plunger.

[00006] The pierce nut installation apparatus of this invention eliminates the problems of accurately locating the pierce nuts installed in a panel, significantly reducing the required number of datums, and substantially eliminates cocking of the pierce nuts in the plunger passage.

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SUMMARY OF THE INVENTION

[00007] The pierce nut installation apparatus of this invention includes a feed passage receiving conventional pierce nuts of the types described above, a plunger passage communicating with the feed passage and receiving pierce nuts from
10 the feed passage and a plunger reciprocating through the plunger passage having an end portion which is driven against a pierce nut received in the plunger passage for installation in a panel opposite the plunger passage as described above. The end portion of the plunger of the pierce nut installation apparatus of this invention further includes a generally cylindrical portion projecting from the end portion of the plunger
15 configured to be received in the bore of the pierce nut having an outer diameter substantially equal to an internal diameter of the bore, preventing cocking of the pierce nut in the plunger passage and accurately locating the pierce nut on a panel following installation. Because the plunger may be very accurately aligned in the die press and the generally cylindrical projection is accurately aligned with the pierce nut
20 bores, the number of required datums is significantly reduced, permitting the use of the axis of the nut bores of the pierce nuts attached to the panel as the datum for alignment. Further, because the generally cylindrical projection is closely received in the nut bore, cocking of the pierce nuts in the plunger passage is substantially eliminated.

[00008] In a preferred embodiment of the pierce nut installation head of this invention, the generally cylindrical projection on the end of the plunger is removable and replaceable to accommodate pierce nuts having different nut bores and replacement. In the disclosed embodiment of the pierce nut installation apparatus of this invention, the generally cylindrical projection is threadably attached to the end portion of the plunger, permitting quick and easy removal and replacement. In the disclosed embodiment, the end portion of the plunger is planar and includes a threaded axial opening and the generally cylindrical portion includes a male threaded end threaded into the threaded axial opening in the end of the plunger.

10 [00009] In a preferred embodiment, the generally cylindrical portion is formed of a material which is softer than the pierce nut, such as a hard polymer and the generally cylindrical projection is frustoconical having a major diameter adjacent the end portion of the plunger having a diameter equal to or slightly greater than the crest diameter of the pierce nut bore providing very accurate alignment of the pierce nut installed on a panel and preventing cocking of the pierce nut in the plunger bore as described above.

[00010] Other advantages and meritorious features of the pierce nut installation head of this invention will be more fully understood from the following description of the preferred embodiments, the appended claims and the drawings, a brief description of which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[00011] Figure 1 is a side cross-sectional view of one embodiment of the pierce nut installation head of this invention;

[00012] Figure 2 is a partial exploded view of the end of the plunger shown in Figure 1; and

[00013] Figure 3 is a side partially cross-sectioned view of the plunger assembly engaging a pierce nut during the installation of a pierce nut in a panel.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00014] The pierce nut installation apparatus or installation head 20 shown in Figure 1 may be attached to a die member of a die press to receive and install pierce nuts in a panel as described above, wherein the pierce nut installation head is typically attached to the upper die shoe by a base member 22 generally including a back-up plate 24. The disclosed embodiment of the installation head assembly includes a shank 26 which receives a coil shank spring 28 which is compressed between a retainer bolt 30 and the upper die shoe (not shown). Alternatively, the spring 28 may be replaced with pneumatic pressure. The shank includes a vertical slot 32 which receives shank stop pin 34 during installation of a pierce nut as described below. The back-up plate 22 is aligned on the upper die shoe (not shown) by dowel pins 36 providing accurate alignment of the installation head 20 on the die shoe.

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[00015] The shank 26 includes a chuting shoe 38 which receives a plastic chute 40 retained by dowel pins 42 which defines a feed passage 44 for receipt of pierce nuts by the installation head 20. The base member 22 further includes a plunger 46 which is retained to the base member by a dowel pin 48. The plunger reciprocates through a nose assembly 50 which defines a plunger passage 52. The disclosed embodiment of the pierce nut installation head 20 further includes a proximity probe 54 which confirms receipt of a pierce nut 56 from the feed passage

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44 to the plunger passage 52 opposite the end of the plunger 46 as shown in Figure 1.

As will be understood by those skilled in this art, the pierce nuts 56 may be interconnected by frangible wires or fed to the pierce nut installation head in bulk.

For simplicity, only one pierce nut is shown in the plunger passage 52 in Figure 1.

- 5 However, during normal operation of the pierce nut installation head, a plurality of pierce nuts 56 will be aligned in the feed passage 44 and a chuck assembly (not shown) feeds the pierce nuts from the feed passage 44 to the plunger passage 52.

[00016] During installation of a pierce nut 56 in a metal panel 58, the panel 58 is supported on a die button 60 having clinching lips 62 and an opening 64
10 which receives the panel slug as will be understood by those skilled in the art. The die button 60 is typically received in the lower die shoe 66 of a die press (not shown) and the base member 22 of the pierce nut installation head 20 is secured to the upper die shoe (not shown). Upon closing of the die press, the nose assembly 50 first engages the panel 58, arresting movement of the nose assembly 50. Continued
15 closing of the die press, drives the end portion of the plunger 46 against a pierce nut 56 in the plunger passage 52, driving the pierce nut against the panel 58, piercing the panel and installing the pierce nut in the panel as is well known in this art. However, as set forth above, there are two problems associated with a pierce nut installation head of this general type which are addressed by the pierce nut installation head 20 of
20 this invention, including (1) accurate alignment of the pierce nut 56 in a panel 58, and (2) preventing cocking of the pierce nut 56 in the plunger passage 52. These objects are achieved by the nut guide element 68 projecting from the end face 70 of the plunger 46 best shown in Figure 2. In a preferred embodiment, the nut guide element 68 is releasably attached to the plunger 46 such that the nut guide element may be

replaced when worn or during installation of a pierce nut having a different size thread cylinder.

[00017] In the disclosed embodiment, the end face 70 of the plunger 46 includes a threaded axial bore 72 aligned with the longitudinal axis 74 of the plunger 46 and the nut guide element 68 includes a male threaded end portion 76 which is threadably received in the threaded bore 72 as shown in Figure 3. The nut guide element 68 further includes a generally cylindrical head portion 78 which projects from the planar end face 70 of the plunger 46 when the male threaded end portion 76 is threaded into the threaded bore 72 as shown in Figure 3. In a preferred embodiment, the generally cylindrical head portion 78 is frustoconical, as shown in Figures 2 and 3, wherein the frustoconical outer surface 80 is tapered at an angle of between two and ten degrees, more preferably between three and seven degrees, having a major diameter at the planar end face 70 of the plunger 46. The circular end face 82 of the nut guide head 78 may also have an Allen wrench opening 84 to permit easy removal and replacement of the nut guide element 68. Alternatively, external wrench flats may be provided for removal. In the preferred embodiment, the nut guide element 68 is formed of a material which is softer than the pierce nut 56, such as a non-ferrous metal, including brass or low carbon steel, but most preferably a polymer, such as nylon, wherein the major diameter of the frustoconical outer surface 80 of the head portion 78 is equal to or slightly greater than the minor or crest diameter of the threaded bore 86 of the pierce nut 56 as best illustrated in Figure 3.

[00018] As set forth above, the pierce nut installation head 20 of this invention may be used for installing any conventional pierce nut, such as the pierce nut 56 shown in Figure 3. The pierce nut 56 includes a projecting pilot portion 88, flange portions 90 on opposed sides of the pilot portion having end faces 92 and re-

entrant or dovetail-shaped grooves 94 in the end faces 92 of the flange portions 90. As is well known in this art, the pilot portion 88 pierces an opening in the panel 58 when the pierce nut 56 is driven against the panel by the plunger 46 and the clinching lip 62 then deform the panel metal into the nut grooves 94.

5 **[00019]** The method of installing a pierce nut, such as the pierce nut 56 illustrated in Figure 3, may now be described, as follows. First, pierce nuts are received through the feed passage 44 into the plunger passage 52 opposite the plunger 46 as shown in Figure 1. The nut guide element 68 is then located opposite the threaded bore 86 of the pierce nut 56. Upon closing of the die press (not shown) as
10 described above, the nose assembly 50 first engages the panel 58 and the planar end face 70 of the plunger 46 is then driven against the pierce nut 56 and the nut guide element 68 is simultaneously received in the nut bore 86. The frustoconical outer surface 80 accurately guides the nut guide element 68 into the bore as shown in Figure 3 and the nut bore 86 is then accurately aligned with the longitudinal axis 74 of
15 the plunger, resulting in accurate alignment of the pierce nut 56 on the panel 58 following installation, eliminating the requirement for a plurality of datums and permitting the use of one datum aligned with the longitudinal axis of the nut bore 86 which is coincident with the axis 74 of the plunger 46. Finally, the nut guide element 68 also prevents cocking of the nut in the plunger passage 52 because the nut is
20 accurately guided by the nut guide element 78 through the plunger passage 52.

[00020] As will be understood by those skilled in this art, various modifications may be made to the pierce nut installation apparatus or head of this invention within the purview of the appended claims. As set forth above, the pierce nut installation apparatus of this invention may be utilized with any pierce nut
25 apparatus having a feed passage receiving pierce nuts for installation by the apparatus,

a plunger passage communicating with the feed passage receiving pierce nuts from the feed passage and a plunger reciprocating through the plunger passage and is therefore not limited to the disclosed embodiment. Although the nut guide element is preferably releasably attached to the plunger, the nut guide element may be attached
5 to the plunger by any suitable connector or may be integral with the plunger. Further, as set forth above, the nut guide element may be formed of any suitable material, including a non-ferrous metal, but in a preferred embodiment, the nut guide element is formed of a hard polymer. Further, the pierce nut installation apparatus of this invention may be utilized to install any pierce or clinch nut and is not limited to the
10 illustrated pierce nut. Finally, in a preferred embodiment of the pierce nut installation apparatus of this invention, the longitudinal length of the head portion 78 of the nut guide element is less than the longitudinal length of the nut bore as shown in Figure 3. However, the head portion 78 of the nut guide element may also have a longitudinal length approximately equal to, but preferably less than, the longitudinal length of the
15 threaded bore of the pierce nut. Having described a preferred embodiment of the pierce nut installation apparatus of this invention, the invention is now claimed as follows.